DOCUMENT RESUME

ED 344 524 HE 025 435

AUTHOR	Clagett, Craig A., Ed.
TITLE	Maryland 2000: Journal of the Maryland Association for Institutional Research.
PUB DATE	Nov 91
NOTE	60p.; Theme issue on institutional research in Maryland.
PUB TYPE	Collected Works - Serials (022) -- Information Analyses (070)
JOURNAL CIT	Journal of the Maryland Association for Institutional Research; v1 Fall 1991
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Access to Information; Accountability; *College Outcomes Assessment; Community Colleges; Computer Software; Higher Education; Information Management; *Institutional Environment; Institutional Evaluation; *Institutional Research; Teacher Attitudes
IDENTIFIERS	Environmental Scanning; *Maryland; Taxographic Space

ABSTRACT

This journal chronicles a sample of the papers and presentations delivered during previous annual meetings of the Maryland Association for Institutional Research on the fifth anniversary of that association. A first paper, one from the first annual meeting in 1987 titled "Environmental Scanning: Assessing Local Business Training Needs" (Craig A. Clagett and Robin B. Huntington), presents an introduction to environmental scanning and the lessons and findings of a collaborative business needs assessment. The second paper, "Student Outcomes Performance Accountability Reports: A Prototype" (Craig A. Clagett) reviews how Maryland's community colleges have responded to the evolving accountability concerns connected with student outcomes with a focus on Prince George's Community College. The third paper, "Accountability and Assessment in Maryland Higher Education" (Shaila R. Aery), discusses a new form of accountability-student achievement as opposed to financial stewardship-and levels of responsibility for assessment. The fourth paper, "Taxographic Space: A Radically Different Paradigm for Information Management" (David A. Webb), describes information management on a taxographic space model rather than the tree paradigm. The fifth paper is by Robin B. Huntington and is titled "Selecting Tools for Institutional Research". It presents an overview of the kinds of computer software useful in institutional research. The sixth article, "When an Institutional Researcher Needs a Statistical Package - And More" (Merrill R. Pritchett) presents a researcher's description of the benefits of using a statistical software package, SPSS (Statistical Package for the Social Sciences). The final paper is "Staff Attitudes Toward Outcome Assessment" by Martha A. Matlick. It presents the results of a survey of attitudes and preferences toward outcomes assessment of over 400 staff in Maryland's public, undergraduate institutions. (JB)

ED344524

MARYLAND 2000

Journal of the Maryland Association for Institutional Research

Volume I Fall 1991

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FOREWORD

The Maryland Association for Institutional Research, in recognition of its fifth anniversary, is proud to present ***Maryland 2000, Journal of the Maryland Association for Institutional Research. Maryland 2000*** was chosen as the title to connote the proactive and forward-looking roles that institutional research and institutional planning typically provide for an institution. This journal, which chronicles a sample of the papers and presentations delivered during previous annual meetings, provides evidence of the advanced ideas that researchers and planners contribute to their institutions.

Craig Clagett, energetic and productive as ever, volunteered to edit and publish this journal for MdAIR. He collected papers or presentations from each of the annual meetings dating back to 1987. We are fortunate that he could retrieve a copy of the paper he and Robin Huntington presented that first year because of its environmental scanning topic and because it is difficult even for researchers to retrieve anything that old. On behalf of MdAIR, the executive committee thanks him gratefully.

We also heartily thank the other contributors to ***Maryland 2000*** – Martha Matlick, Merrill Pritchett, David Webb, and Koopsappa Rajasekhara for his transcription of Shaila Aery's keynote address at the 1989 meeting. As you read through the journal, finding articles on environmental scanning, accountability and assessment, new tools and techniques, and state visions of higher education, I hope you will come away with a deeper appreciation of your colleagues and a strengthened awareness of the diverse nature of our profession.

So enjoy. MdAIR hopes that this will become the first edition of a journal published on a timetable yet to be determined. And as Craig suggests, should the journal still be in existence in the year 2000, whoever is around can change the title!

Pat Haeuser
President, MdAIR

Environmental Scanning: Assessing Local Business Training Needs

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First MdAIR Conference
November 13, 1987

Introduction

There is increasing interest in environmental scanning among colleges and universities of all types and sizes. Because our institutions have been heavily involved in scanning activities, we have been asked to share our views and experiences with the members of the Maryland Association for Institutional Research. More specifically, we were asked to present an introduction to environmental scanning, and to share the lessons and findings of a collaborative business needs assessment conducted by our institutions. Accordingly, our presentation is divided into two parts.

A Primer on Environmental Scanning

In these changing times, institutions must be prepared to adapt to their environment if they are to prosper. Colleges and universities are little different from commercial enterprises in this regard. The corporate technique of environmental scanning—a formal process of assessing trends and forecasting events in the institutional environment in order to evaluate the challenges and opportunities they may present—is increasingly being used by colleges and universities. Sessions at meetings of the Society for College and University Planning document the spreading interest in scanning, and lead us to the following conclusions concerning the current state of higher education scanning:

1. We are convinced of the value of a formal environmental scanning process, one that forces college decisionmakers to look at issues they might otherwise overlook or ignore.

2. We agree that the implementation of proactive, anticipatory policies is the goal—policies that will be robust under a variety of futures.

3. We applaud the recognition that uncertainty must be explicitly addressed, and the emphasis that forecasts are not predictions, that they are transitory, and that they are used to develop alternative futures.

4. We are intrigued by the use of cross-impact analysis in the generation of alternative scenarios, although we have reservations about its complexity and difficulty.

5. We argue that the ultimate criterion for judging the value of a formal scan is that it result in policies that could not have been developed without having gone through the process.

6. We are concerned that the models being advocated are often extremely costly in time and effort and thus may discourage scanning activities at many institutions.

Should Colleges Do Environmental Scanning?

Why should an institution invest scarce resources in a formal scanning process? An effective scan promises to improve the quality of college planning and decisionmaking, by alerting those leading the organization to challenges and opportunities in its environment. Specific uses of environmental scanning results might include: the assessment phase of strategic planning, unit operational planning, marketing plan development, accreditation self-study reports, fundraising and proposal writing, lobbying, and public relations.

Two Alternative Scanning Approaches

Scanning at American colleges and universities tends to take one of two approaches. The literature commonly discusses the committee approach, with committee members responsible for scanning a particular aspect of the environment using a variety of sources, often preparing written abstracts then used to develop strategic implications to guide planning. This is a costly approach, involving top people—as it must if it is to be most effective. This committee process can be beneficial for an institution that has not recently examined its external environment in a formal way.

The committee approach can become quite elaborate. For example, a college might implement a comprehensive scanning process consisting of systematically examining assumptions about the future of the institutional environment and then using the results to develop organizational strategies. This might involve as many as 30 college administrators, faculty, and staff in a Delphi panel, asked to forecast trends and events relevant to the college's future. Three rounds of Delphi surveys are commonly conducted to identify and forecast the probability of events and trends occurring, and to assess the positive and negative consequences of each event or trend on the institution. Panel members might forecast such trends as the number of industries in their region using robots by 1995 and 2000. The rationale is that the decisionmakers, by participating in the forecasting, will "own" the analysis and thus find it credible for developing policy options.

However, decisionmakers may reach the opposite conclusion. Asking panel members to forecast as many as a hundred such trend levels and event probabilities—a charge far beyond the participants' expertise in almost all instances—can undermine rather than increase the credibility of the process, since each panel member knows how weakly based his or her own forecasts are. In any case, the multiple-round Delphi process is very time-consuming, and often leads to participant burn-out and even drop-out. Even if followed through to completion and effective in terms of enlightening people and helping form policy options, the process cannot be described as efficient.

An alternative approach to environmental scanning is to assign the task to the institutional research and planning office, with top management brought in at the policy analysis stage. The planning or research shop can confront decisionmakers with provocative yet credible futures based on a scan of expert sources, and the top managers can deliberate on possible impacts on the institution and on developing appropriate policy options, rather than investing scarce professional time in a structured scanning process. Top management, through their routine reading, will be familiar with many of the issues raised by the formal scan, and the annual or biennial scanning report presented at a formal planning meeting can raise the key issues for focused discussion.

In a sense, this makes the research office the champion of scanning, with the function of keeping external factors visible to decisionmakers. While there may be some danger in thus "bureaucratizing" scanning as a separate activity—executive players' perceptions are important—the losses may be offset by the much greater cost efficiency of this approach. Indeed, this is the easiest approach from an institutional standpoint and may be the only method that gains adequate backing. However, a commitment to active dissemination of the findings is essential for this approach to be effective. Otherwise, useful information may remain unread and unused.

Environmental Contexts

The institutional-research-based approach has been successful at several institutions, even when conducted by a single individual. The "solo scanning" approach must be comprehensive, however. At least six environmental contexts should be monitored:

Demographic. The decline in high school graduates, reaching its national nadir in the early 1990s, will be accompanied in most areas with increases in older populations. In addition to the shifting age composition, other population trends to be monitored for their institutional implications include changes in ethnic composition and household characteristics.

Economic. Economic conditions may affect not only students' ability to pay (with implications for tuition schedules and financial aid) but interest in attending college. Trends in local, state, and federal governmental revenues may affect institutional funding levels. Changing industrial patterns may alter local occupational demand, with programmatic implications. Changes in tax policy may impact on philanthropic contributions.

Legal-political. Educational institutions inevitably participate in local, state, and federal political processes. Public institutions must be intimately involved in budgetary politics, but private colleges also participate in politics, from financial aid issues to town-and-gown relations. Colleges must be attuned to how changes in other contexts may have political ramifications. The national educational accountability movement is largely a political phenomenon.

Organizational-competitive. In addition to governmental and political actors, colleges and universities interact with many other organizations. The quality of institutional relationships with other higher education institutions, secondary schools, business and industry groups, professional associations, accrediting agencies, and other organizations can directly affect achievement of college goals. Scanning in this context must also include assessment of the competition, not just other colleges but public schools' adult education offerings and corporate training programs.

Socio-cultural. Changing cultural attitudes and behavior have programmatic and marketing implications for colleges. Dual income families, increased female workforce participation, multiple career changes, and, in general, more heterogeneous lifestyles, have colleges adjusting schedules, providing child care, and developing innovative delivery modes.

Technological. Changing technology affects both what colleges teach and how they teach it. New programs in information systems, robotics, and the like are the obvious manifestations, but equally important are the new ways instruction is being delivered. Interactive videodiscs, cable and satellite communication, and other information technologies may portend new roles for faculty and new relationships with students. Office automation (e.g., microcomputers) has altered the manner in which even the most routine campus tasks are performed. Half of today's labor force works with computers or computerized machinery. Unless people have sufficient education and initiative to take advantage of the new kinds of work, they may fall out of the mainstream economy.

Identifying these six contexts for environmental scanning encourages a comprehensive approach sensitive to the diversity and turbulence of factors affecting colleges today. The solo scanner must include all of them in his or her efforts; an incomplete scan can mislead an institution into a false sense of security. Most colleges track demographic and economic trends, but many pay insufficient attention to the legal-political and organizational environments.

Scanning Sources

Sources of information for keeping on top of environmental trends are numerous and varied. Several sources will be identified below, starting with national trends and getting successively more localized.

National sources. The fundamental source is the Bureau of the Census of the Department of Commerce. To keep up with Census information, subscribe to its *Monthly Product Announcement* and *Census and You*. Also obtain their telephone contact list of staff specialists; we have found them extremely professional and helpful. Also available is *CENDATA*, the Bureau's on-line data service. Other good sources of national data are *American Demographics* magazine, and especially its monthly bulletin *The Numbers News*. If we had to limit ourselves to only one national source and had limited time to devote to scanning, *The Numbers News* would be our choice. National sources with a focus on education include *The Chronicle of Higher Education*, and the American Council on Education's Cooperative Institutional Research Program.

State sources. Official state agencies can provide a wealth of useful planning information. Maryland's state planning office, for example, makes Census and other data available on diskettes as well as in printed reports. They publish a data center newsletter with both analysis and product announcements. In addition to periodic population projections, Office of State Planning publications of particular usefulness include public school enrollment projections and jurisdic-

tion migration flow trends. The latter publication was especially useful in explaining enrollment growth at the community college during a period when overall county population did not change. Another source of population data is the state Center for Health Statistics. The Maryland Chamber of Commerce issued a publication that identified over 50 issues of "utmost concern" to the Maryland business community. In one convenient source, the environmental scanner gains a perspective on what's important to area businesses. While not a substitute for personal interaction with industry leaders, such publications can be good background material to sensitize college planners to the positions of a major constituency. For solo scanners, such shortcuts are invaluable.

Metropolitan area sources. Colleges in or near major metropolitan areas can benefit from many municipal, association, and private sources. City agencies often provide data similar to that available from state governments, but for a more focused geographic area. Local governments sometimes cooperate in planning endeavors that produce valuable data for college scanners. For example, the Metropolitan Washington Council of Governments produces cooperative population and economic forecasts and issues a regional newsletter. Professional business organizations, such as the Washington/Baltimore Regional Association, are a good source of industrial and economic information. Some local chapters of the United Way prepare planning reports of high quality. The United Way of Central Maryland, for example, has produced an environmental scanning report available in a 37-page booklet or a slide program with tape narration. Large cities may have private research firms that produce reports available to the public. Local research firms in Washington, for example, have issued reports from changing lifestyles to financial projections for local jurisdictions. Finally, larger cities often have their own magazines and business periodicals as well as major newspapers, all of which provide a continuous source of relevant scanning information.

County sources. Commuter schools, especially community colleges with lower district tuition and thus concentrated service areas, need county-level data. County government planning offices, economic development corporations, and local chambers of commerce are all sources of county data and forecasts. Scanners also need to be alert for one-time events and commissions that can produce valuable information. For example, the county executive and local business leaders in Prince George's County, Maryland, initiated a Strategic Planning Group for the county that produced a 45-page report with analysis and strategies for issues in education, public safety, employment, and public service financial stability.

The above discussion is meant to be suggestive of what may be available for the solo scanner. By locating and using existing trend reports and forecasts, a meaningful environmental scan can be done by a single energetic researcher.

Dissemination of Scanning Findings

The most thorough environmental scan is of little value if decisionmakers are not made aware of its findings. Effective dissemination of scanning results is a key part of the process. This is especially important for the solo scanner, since the involvement of top people assumed in the committee approach is largely absent.

Dissemination for a college completing its first major scan might follow the following pattern. The first step would involve a formal briefing presented to the college's planning council, president's cabinet, or equivalent top administrative group. This provides for important feedback to the scanner, and may initiate additional work before any further dissemination. Once top management is satisfied with the scanning results, a series of formal presentations to college groups is recommended. These would include, first, the governing board of trustees or regents, and then the faculty senate and classified staff organization. A series of written reports with the detailed data supporting the major briefing findings should be distributed to the administrative staff, and available to others on request. If the college publishes a Master Plan or similar document, environmental scanning findings make an ideal chapter preceding the strategic plan itself. Finally, a two-or-three page memo summarizing the scanning highlights should be circulated among all employees of the college.

Effective dissemination requires that the scanner think in terms of simple communication. While the scanning process may involve sifting through thousands of pages of material and hundreds of hours of interviews and conversations, the final message that gets though will necessarily be brief.

Environmental scanning is too important to effective planning to be avoided due to cost reasons. Colleges, no less than corporations and governments, need to understand what is happening in the environment in which they exist. We have attempted to show how scanning can be accomplished in a cost-efficient manner; indeed, we argue one person can do a valuable scan by identifying the right sources and by disseminating the results effectively. The solo scanner can contribute to institutional effectiveness and enhance his or her own professional development at the same time.

Local Business Needs Assessment Survey

Postsecondary educational institutions have an important role to play in supporting economic development. In Prince George's County, Maryland, the local Chamber of Commerce, anxious to assist county business development, initiated discussions with two local colleges leading to a collaborative project to assess employee educational and training needs. Representatives from the Chamber of

Commerce, University of Maryland University College, and Prince George's Community College met several times over the summer of 1987 to plan a survey of county businesses aimed at identifying the training and professional development activities desired most by county business leaders. In this section we describe the genesis and findings of this collaborative project.

An initial concern in the design of the study was ascertaining the number of businesses operating in Prince George's County. One source, based on universe files and thus not subject to sampling error, was *County Business Patterns*. This annual publication of the U.S. Bureau of the Census presents data on number of establishments, total employment, and payroll on an establishment basis, classified by the principal economic activity at each individual location. An establishment is defined as a single physical location where business is conducted or where services or industrial operations are performed. Each location of a multilocation firm active during the year (presence of payroll in any quarter) is counted as an establishment. All wage and salary employment covered by FICA is included; employment totally exempt from FICA—primarily government and self-employed workers—is excluded. Establishment size designations are measured by paid employment in the pay period including March 12th. The federal Standard Industrial Classification (SIC) is used to categorize firms by principal economic activity. Unclassified establishments, typically new businesses, include establishments that cannot be classified in any major industry group due to insufficient information.

According to *County Business Patterns*, a total of 11,592 establishments were operating in Prince George's County in 1984. These locations employed 187,838 workers. (An additional 21,905 civilian federal employees were working in the county. For security reasons, employees of the CIA, NSA, and FBI were excluded from this total.) Most establishments had few employees; indeed, two-thirds of all employment locations had fewer than ten employees. The mailing list used for the survey provided a more recent breakout of county businesses. According to the mailing list provided by the private mailing list broker, a total of 15,125 business locations were active in Prince George's County in 1987. The basic source of the data was nonresidential phone listings, supplemented by several file overlays to provide an up-to-date and informative data set. No part of the file was more than a year old. The fifteen thousand figure included each location of firms with multiple sites in the county. Retail trade, services, professional services (health, legal, educational, etc.), and construction firms were most populous on both the 1984 and 1987 lists.

Methodology

Because the resources the three collaborating institutions had available for this project were limited, a one-shot mail survey was conducted rather than a more expensive research design employing personal or telephone interviewing. The time frame precluded a follow-up mailing to nonrespondents. Using this less-than-desirable research design, the research team hoped for a ten percent return. A sample size of 5,000 was chosen in anticipation of 500 usable responses. The large

mailing was also valued for its marketing benefits; even nonrespondents would be alerted to the eagerness of the three institutions to serve their employee training needs.

The vast majority of business locations in the county employed fewer than ten people. Because the research team wanted to analyze the survey responses by size of firm, all locations with ten or more employees were included in the sample, with the balance randomly selected from those with fewer than ten.

The basic research questions guiding instrument design were:

1. What types of management and employee development training are most needed by county businesses?

2. To what extent are county businesses already involved in formal training programs?

3. What is the preferred format for training?

4. What can local educational institutions do to promote business success in the county?

5. Do the responses to the above questions vary by firm size or industry?

The final four-page questionnaire contained 17 questions and was prepared for printing in booklet form using Ventura Publisher desktop publishing software.

Limitations

A total of 182 businesses had responded to the survey by the time analysis commenced. This response rate of about four percent raised questions about how representative the respondents were of the population of businesses in the county. Significance tests were run which indicated that the respondents, in terms of size and industrial classification, were not what would have been expected by chance. Respondents with more employees were more likely to have responded than those with smaller workforces, even after adjusting for the sampling procedure. The pattern of respondents by industry was also biased, with construction firms overrepresented and retail firms underrepresented. The profile of respondent characteristics suggested that firms new to the county may have been underrepresented. (Because population data were unavailable, significance tests were not run on this variable.) While the respondents were a diverse group, generalizations of the findings of this study to the larger population of all county businesses were not warranted. The conclusions from the survey appropriately applied only to the businesses that responded.

Without a telephone follow-up of nonrespondents, precluded by time and cost constraints, we did not know in what other ways the respondents may have differed from the nonrespondents. It was hoped that Chamber of Commerce sponsorship (the questionnaires were mailed in Chamber envelopes with a Chamber cover letter) would elicit a higher response. One could conjecture that the sampling of business locations, which included individual sites of larger multilocation firms, might have had a dampening effect. A small branch location might have interpreted the questionnaire as more appropriate for central office completion. Small businesses (90 percent of the sample had fewer than ten employees) might not have immediately seen the relevance of the survey to their needs. This interpretation was supported by the finding that more large companies and fewer small companies responded than would have been expected by chance.

Findings

In this section, the major findings of the survey are highlighted. The purpose is to illustrate the kinds of information that can be learned from a survey of this type.

Existing Training Activities. Nearly three of every five respondents indicated that their employees had participated in some form of formal education or training within the last year. Most training was done out-of-house, as only 37 percent of the respondents had formal in-house training programs. Over three-fifths of the respondents indicated a willingness to financially support employee professional development, primarily through reimbursing employees who complete courses. Twenty-five respondents (14 percent) indicated a willingness to pay for employee training through a contract arrangement.

Types of Training Needed. Employee skills most in need of improvement were oral communications, interpersonal relations, and writing. A majority of the respondents indicated a strong need for training in each of these areas. Over a third of the respondents indicated a strong need for training in microcomputer usage and word processing. The mean rating for each type of employee development, based on a five-point scale (from 1 signifying not needed to 5 for strongest need), were as follows:

Mean Ratings of Employee Development Needs

Oral communications skills	3.7
Interpersonal relations	3.6
Writing skills	3.4
Microcomputer skills	2.9
Word processing skills	2.8

Training in collections and accounts receivable was strongly needed by two of every five respondents. Developing marketing and business plans, and training in general business accounting, were items of strong interest to over a third of the respondents. Three in ten expressed a strong need for updated training in personnel law and business tax law. Only four percent felt a strong need for instruction in import/export procedures. Mean ratings for these management-oriented training areas were as follows:

Mean Ratings of Management Training Needs

Collections/accounts receivable	3.0
Designing marketing plans	3.0
General business accounting	2.9
Developing a business plan	2.8
Personnel/hiring law	2.8
Business tax law	2.7
Import/export procedures	1.4

Desired Characteristics of Future Training. The format for training most favored by the respondents was open-enrollment courses offered weekday evenings at existing college campuses or centers. The respondents did not reveal a strong preference for credit versus noncredit coursework. While 46 percent indicated some form of noncredit training was preferable, 27 percent favored credit classes with the remaining 27 percent having no preference either way. Eighteen percent of the respondents favored courses specifically tailored to their needs (as opposed to open-enrollment courses); nine percent preferred courses delivered on-site at their place of business. Fifty-seven percent preferred courses offered on weekday evenings. The next most popular time was Saturday mornings, checked by 21 percent.

Contingency Table Analysis. Several crosstabulations were performed to see if respondent answers varied systematically by firm size, industry classification, or other variables. For most questions, no relationships were found. However, businesses that had formal in-house training programs were more likely than those that didn't to express needs for employee development in interpersonal relations, oral and written communication skills, personnel law, and development of marketing plans. Larger firms expressed a stronger need for microcomputer training than those with fewer employees.

Responses to Open-ended Questions. Respondents were asked to indicate how local educational institutions could help them improve their business performance, in terms of specific training or (more generally) the education provided college graduates in their employ. A complete listing of employer comments was compiled, but several themes stood out. Basic reading, writing, and speaking skills were mentioned repeatedly, as needed and lacking in many job applicants. Also mentioned frequently was development of a "work ethic," with punctuality, motivation, proper dress and attitude, and willingness to work hard specifically cited. Customer relations, dealing with the public, and other interpersonal relations skills were areas of concern common to many respondents. Finally, several employers argued for more practical experience and less "theory" in the curriculum.

Summary of Survey Findings

A total of 182 Prince George's County business establishments responded to a survey to assess local business educational and training needs. The survey discovered a diverse set of respondent needs and preferences for training. However, several patterns emerged from the analysis:

1. Employee training was valued by County businesspeople. Nearly three-fifths of the responding firms said their employees had participated in formal training programs during the previous year; over a third of the respondents had formal in-house training programs. Over half said they would financially support employee professional development.

2. Employee skills most in need of improvement were oral and written communication and interpersonal relations. Written comments expressed a desire for greater commitment to the "work ethic" among new employees.

3. Over a third of the respondents expressed a need for improvement in collections/accounts receivable, developing marketing and business plans, and general accounting.

4. Most respondents preferred open enrollment courses offered at existing college locations, with weekday evenings and Saturday mornings the more popular times. Less than a fifth were interested in courses specifically designed for their needs, offered at their place of business. Only a fourth of the respondents indicated college credit was important, with nearly half preferring noncredit courses and the rest not having a preference.

5. Based on the responses of this limited sample of County businesses, it appeared that the community college and the university's continuing education/professional development division were well positioned to meet local employee training needs. The two institutions together offered credit and non-credit open enrollment courses in most of the subject areas mentioned by the respondents, taught in formats in accord with respondent preferences. In addition, the survey elicited several leads which yielded contract training arrangements for both institutions.

Conclusions

We have attempted to demonstrate the usefulness of a formal environmental scanning effort, with an emphasis on a cost-efficient approach feasible for most institutions. We have also discussed the benefits and limitations of a collaborative survey to assess local business training needs. We encourage others to conduct scanning activities and to report, in settings such as this one, both the positive and negative lessons learned.

Student Outcomes Performance Accountability Reports: A Prototype

CRAIG A. CLAGETT
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Second MdAIR Conference
November 11, 1988

Introduction

Institutional accountability, particularly as demonstrated by student learning outcomes assessment, rose to the top of the higher education agenda during the 1980s. Led by state initiatives in Tennessee, New Jersey, and Virginia, by 1987 two-thirds of the states had requirements that public institutions show evidence that they were producing desired outcomes for students. In 1988, Maryland joined those with legally mandated accountability requirements. This paper will review how Maryland's community colleges have responded to the evolving accountability concerns, with a focus on Prince George's Community College.

Accountability in Maryland

The movement for a formalized, state-coordinated institutional assessment procedure began in March 1980, when the Legislative Auditors Report on the Maryland State Board for Higher Education (SBHE) recommended that SBHE develop and implement a system for evaluating educational programs. The Board was further encouraged to study the option of testing students prior to graduation for basic skills. As a result of this recommendation, SBHE compiled a set of data drawn from existing systems and distributed it under the title "Indicators of Campus Viability." A Joint Chairs Report in April 1984 recommended that SBHE pursue the use of existing standardized test results to evaluate student proficiency. The Legislative Auditors Report on SBHE in May 1984 reiterated its previous recommendation and specified that if existing standardized tests were found to be inadequate, the Board was to develop an alternative testing method. SBHE's response was to appoint an advisory committee of segmental representatives to examine the feasibility of testing. The advisory committee reported in December 1984 that if testing was to be used to measure educational outcomes, such a test should include a "value-added" approach and should measure general cognitive development, rather than simply test basic skills. Two options were included in the report: a single test for all public institutions or campus-designed testing programs. The

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committee recommended the ACT-COMP if the first option was selected. The segment heads reviewed the advisory committee's report and recommended the first option, a single statewide test. However, the staff and the Board preferred a new instrument, to be developed by ETS for Maryland, rather than using the COMP. On February 13, 1986, the Board approved a policy statement as part of the Statewide Plan for Postsecondary Education that called for development of a program for testing college students completing their sophomore year. All segment heads approved the initiation of a pilot rising-junior outcomes assessment to be conducted in spring 1987. However, approximately a week later, a petition to transfer SBHE funds necessary for the planning and development of the pilot program was denied by the Department of Budget and Fiscal Planning and the Governor's Office. As a result of this action by the Executive, SBHE decided to pursue the second option recommended by the advisory committee: establishing campus-based testing and assessment programs.

Deliberations of a new segmental study group led to a March 1987 policy statement by SBHE listing guidelines for institutional assessment. Each campus was to develop an assessment plan to include:

1. A clear statement of those outcomes the institution expects to produce.

2. An explicit assessment of the degree to which the institution is attaining these outcomes. This assessment should:

   a. include the coordination, collection, and use of existing campus measures and indices;

   b. include outcomes indicators which emphasize general education and higher-level cognitive skills and which incorporate value added and/or other appropriate comparative measures;

   c. be based on an approach that would allow the college to analyze results over time.

In addition to providing accountability to the governor, legislature, and public, this process was intended to provide feedback to the college to promote institutional renewal and program improvement.

In October 1987, SBHE issued the first draft of procedures for the implementation of the policy guidelines on assessment of institutional outcomes. Over the next few months, several revisions were made, largely reflecting input from the University of Maryland. On June 23, 1988, the State Board for Higher Education approved the "Procedures for the Implementation of the State Board for Higher Education Policy Guidelines on Assessment of Institutional Outcomes." This document outlined the development of institutional outcomes assessment

plans to include a statement of institutional mission and goals, student performance goals, program effectiveness goals, and administrative performance goals. The institutional assessment plans were to be completed and approved by institutional governing boards by July 1, 1989. Every year, beginning November 1, 1989, the president of each institution was to submit to its governing board a written report on the attainment of the objectives in the institutional assessment plan. These procedures were adjusted to conform to the accountability language of Senate Bill 459, enacted in 1988 as the "Administration Action Plan for Higher Education." In addition to reorganizing higher education in the state (creating the Maryland Higher Education Commission to replace SBHE, creating a new University of Maryland System), S.B. 459 mandated the above mentioned accountability plans and reports. The new commission, MHEC, charged with establishing the format for these required documents, appointed an Accountability Advisory Committee of segmental and institutional representatives to help in this charge.

Current Student Outcomes Assessment Activities

While the final state guidelines were yet to be adopted, individual institutions in the state began to examine their assessment activities. Most community colleges in Maryland were in a relatively good position to respond to the new accountability requirements. Ongoing assessment activities were well established at most colleges. They included:

State Reporting Systems. All Maryland public community colleges submit enrollment, graduation, and discipline cost data to the state coordinating board on computer tape. These files, part of the Enrollment Information System (EIS), Degree Information System (DIS), and Discipline Cost Analysis (DCA), are analyzed by the state board and displayed in its Program Data Monitoring System (PDMS). The PDMS provides, for each credit program at each college, trends over time and comparisons among colleges in enrollment, awards, unit costs, follow-up survey findings, plus local and state job forecasts. The PDMS program includes quantitative criteria which "flag" college programs deviating substantially from state averages or showing dramatic changes. State board staff identify three or four programs each year for more in-depth, qualitative evaluation. Colleges are asked to respond in writing to a series of questions framed by state staff about the identified programs. The responses are compiled and published in a program evaluation anthology by the state board each year. In addition, occupational program graduate placement rates, employer ratings of graduates' community college training, pass rates on nursing examinations, and transfer student success indicators for each college are published in the state board's annual *Performance Profile*.

Surveys Coordinated by the State Board. Surveys designed by the Maryland Community College Research Group (MCCRG) and coordinated by the Maryland State Board for Community Colleges (SBCC) are important sources of assessment data. In addition to routine surveys of graduates and their employers, the MCCRG/SBCC studies include follow-up surveys of entering classes four years after college entry and surveys of noncredit, continuing education students.

Certification/Licensure Examination Performance. The pass rates of the colleges' graduates on national or state licensing or certification exams provide an external measure of program success. While nursing and allied health exams are perhaps the most common, exam results in real estate and other professions are also included in assessment studies.

Transfer Performance Reports from Senior Institutions. Maryland community colleges receive some information on the academic progress of their former students at selected campuses of the University of Maryland. Grade point averages, academic standing, credits attempted and earned, and other data are shared. Efforts are underway to expand both the data set and the number of institutions participating in this activity.

Qualitative Program Evaluations Conducted by Colleges. Many community colleges in Maryland conduct their own in-depth program evaluations, often but not always in conjunction with SBCC requests associated with the Program Data Monitoring System or with accreditation activities.

Institutional Research Studies. Finally, most institutions have an institutional research office involved in studies related to student outcomes assessment. These studies range from the placement and transfer findings from surveys to elaborate, multivariate research designs of student persistence.

A review of existing student outcomes assessment activities among Maryland community colleges suggests the following as major strengths:

1. Existing processes provide a fairly comprehensive review of short-term employment and transfer outcomes.

2 Existing processes have been conducted consistently for nearly a decade, permitting trend analysis.

3. Existing processes include many collaborative statewide data collection efforts, permitting comparative analysis.

The following are major weaknesses, in light of the emphases of initial state guidelines on assessment:

1. Existing processes do not explicitly evaluate general education and higher-level cognitive skills, or the development of critical thinking, clear expression, and responsible citizenship.

2. Existing processes do not incorporate value-added or other comparative measures evaluating student achievement in terms of improvement in the skill and knowledge levels students brought to the college.

One College's Response: A Student Outcomes Accountability Report

Monitoring and assessing student progress and achievement are ongoing activities at Prince George's Community College. At the most fundamental level, faculty evaluate student achievement in the classroom, laboratory, and athletic field. Instructional departments and divisions monitor their courses and programs for effectiveness. The institutional research office conducts numerous studies each year examining student achievement and persistence. The college participates in the many systematic analyses coordinated by the State Board for Community Colleges described earlier.

In response to the SBHE policy directives issued in 1987, the college recognized the need for a comprehensive look at its extensive assessment activity. The president appointed a collegewide Task Force on Institutional Assessment in August 1987, with the charge to make recommendations for the college's response to the SBHE call for an outcomes-oriented assessment plan. The task force first explored the merits of using standardized testing. After much deliberation, the task force rejected this approach. Instead, two committees were established: one to investigate enhancements to existing program monitoring efforts, and another to focus on assessment of general education. Preliminary committee reports were made in May 1988. Due to the ongoing legislative activity and uncertainty about what the new commission would require, the task force recessed indefinitely, after recommending that the institutional research office compile a comprehensive report to the Board of Trustees on existing student outcomes information.

In November 1988, the institutional research office presented its *Student Outcomes Performance Accountability Report* to the Board of Trustees. This 84-page report included data on student course completion rates, term-to-term retention, persistence to degree completion, transfers to senior institutions, graduate employment, employer evaluations of graduate job performance, licensure examination results, general education outcomes, and continuing education outcomes.

Application of Outcomes Data to the Accountability Plan

The state-mandated accountability plans, although their final format has not been dictated by MHEC, will clearly emphasize student outcomes. In informal discussions, colleges have been encouraged to state specific student outcomes objectives in their plans, including the indicators to be used and targets to be attained. The student outcomes report prepared by the institutional research office was invaluable in preparing Prince George's Community College's accountability plan.

In this section, three examples of the application of institutional research findings to the development of accountability objectives will be presented. The examples will demonstrate absolute and comparative standards, time trends and peer institution comparisons. It will be clear how each performance objective in the accountability plan rests upon outcomes data analyzed by the office of institutional research.

Occupational programs at the community college are designed to prepare graduates for immediate entry into a career. One indicator of program success is the percent of graduates finding full-time employment in a job related to their college program within a year of graduation. The research office has obtained this information through annual follow-up surveys since the early 1970s. Findings for the larger occupational programs at Prince George's from the last three surveys were as follows:

Graduate Respondents Employed Full-time in Jobs Related to PGCC Program

Program	1985	1986	1987
Allied Health	79%	83%	86%
Nursing	82%	75%	76%
Office Technology	75%	71%	75%
Computer Technology	48%	85%	70%
Accounting	70%	69%	67%
Criminal Justice	50%	59%	67%
Business Management	64%	58%	59%
Paralegal/Legal Assistant	55%	50%	54%
Electronics Technology	61%	63%	53%
Marketing Management	60%	35%	36%

The performance objective associated with these data reads as follows: "At least three-fifths of the graduates from each occupational program will be employed full-time in a related field within a year of PGCC graduation." The standard reflects awareness that students may postpone their job search for various reasons; but a program designed primarily to prepare for immediate job entry that fails to regularly achieve a 60 percent placement rate warrants further review. For example, most Marketing Management graduates are opting for further education—an indication that the curriculum objective and standing may need to be changed to reflect a transfer orientation. A similar analysis led to creation of a new Information Systems and Computer Science transfer program, with the result that the placement rate for the Computer Technology occupational program increased to above the 60 percent threshold.

Graduates of health technology programs usually sit for licensure or certification examinations. The college gains valuable feedback from this external evaluation, and content area subtest scores are used by faculty for monitoring program effectiveness. The overall pass rates on these exams are also used by the college as annual evaluation measures:

Pass Rates of PGCC Graduates on Certification Examinations, 1987

Program	Exam	PGCC Candidates	PGCC Passed	Nationwide Pass Rate
Medical Isotope	ARRT-NMT	8	75%	66%
Medical Records	ART	8	88%	89%
Nursing	NCLEX-RN	110	88%	93%
Radiography	ARRT-Rad.	15	47%	87%
Respiratory Care	CRTT	6	100%	65%

The performance objective associated with these data states that "Completers of PGCC programs who take licensure or certification examinations will pass at a rate equal to or greater than the appropriate state or national average." Substandard pass rates, such as that of radiography in 1987, signal a need for further review. Although graduates have had difficulty with the ARRT-Radiography exams on the first attempt, most have become certified on subsequent attempts. Faculty follow-up found that only 2 of 65 graduates since 1982 have not obtained certification.

Preparation for transfer to senior institutions for completion of the baccalaureate remains a primary community college mission. One measure of college success in this mission is the performance of its transfer students at four-year colleges and universities. Prince George's receives selected student performance data from the University of Maryland College Park, where about a third of the community college's transfers go. The University provides similar data to the other Maryland community colleges, which permits comparisons such as the following:

Academic Performance of Maryland Community College Transfers at the University of Maryland College Park, Fall 1987

Community College	Number Enrolled	Percent in Good Standing	Mean Cumul. G.P.A.
PGCC	**1,181**	**84%**	**2.48**
Peer A	348	86%	2.55
Peer B	132	83%	2.49
Peer C	102	91%	2.63
Peer D	2,170	87%	2.58
All Maryland CC Transfers	**4,584**	**86%**	**2.54**

The performance objective associated with these data states that "The academic performance of PGCC transfers at senior institutions will equal or exceed that of transfers from comparable Maryland community colleges."

Accountability Issues for Institutional Research

The preceding discussion demonstrates the important role institutional research can play in the accountability planning process. Without a history of sound outcomes research, it would be difficult to set the realistic, specific student performance goals required by the state mandate. Maryland's community colleges are fortunate in having an active professional association, the Maryland Community College Research Group, and a cooperative state coordinating board that together have established statewide reporting systems and conducted joint research studies for nearly two decades. Much of the data needed for accountability purposes are already routinely collected and analyzed. Equally important, many of the political issues—such as releasing institutional comparative data—have been settled. The new accountability initiatives have raised several issues for institutional researchers, however, including the following:

1. Are existing data systems and sources sufficient for the task at hand?

2. How can the diversity of student goals be accounted for in the development of meaningful outcomes measures?

3. In what areas are common definitions and methods needed to permit valid inter-institutional comparisons?

4. How can community colleges obtain transfer student performance data from senior institutions while ensuring student record confidentiality?

5. Can we develop a satisfactory alternative to testing for assessing general education outcomes?

6. Should student performance goals be stated in absolute or comparative terms?

7. Is there a role for national, regional, or state professional associations in this process?

While much has been done, the above questions demonstrate that much remains. It is with good reason that the state accountability initiative has been called "The Institutional Research Full Employment Act."

Accountability and Assessment in Maryland Higher Education

SHAILA R. AERY
Maryland Secretary of Higher Education

Third MdAIR Conference
November 17, 1989

I've been asked to talk about many interesting topics, but I think the one I've been asked to address this morning is one of the more interesting ones, certainly one that Dr. Phipps and his staff have been wrestling with, and that is the issue of accountability and assessment. As you know better than I, the whole discussion on the reorganization of higher education in Maryland had a great deal to say about accountability and assigned the responsibility of implementing an accountability process to the new Maryland Higher Education Commission. Accountability in education has received a lot of attention in the state since the National Governors' Association task force in 1987. I had the privilege of going around the country with the task force and listening to the hearings on assessment and accountability. The governors concluded, and I quote, that it "was clear that most colleges and universities cannot demonstrate that student learning has occurred." Now, one result of that task force report has been a great deal of pressure on all of the states for a new form of accountability – demonstrated achievement rather than just financial stewardship, which we've been used to previously on accountability issues, and quality judgments based on student academic success rather than student selectivity.

At the recent summit meeting on education there was very little said about higher education by President Bush and the governors. But at the one session that did occur, the governors were adamant about higher education needing to be more accountable. It was the only thing they really talked about, that and cost containment, when it came to higher education.

There are, I think, several reasons why governors and elected officials across this country are concerned about and interested in accountability and assessment. One reason has to be the amount of state tax dollars invested in higher education. In Maryland we have witnessed, at least in 4-year institutions, the base increase by a third over two years. That has prompted many legislators to talk to me about assessment and accountability. Now that they've put the money in, they want to know

what they've gotten. Coupled with this are the discouraging reports by employers that our graduates' verbal and math skills are not what they would expect from a college graduate.

A related reason that I think governors and elected officials are concerned with outcomes is that we have done a very good job of convincing elected officials how important we are as an investment in the future of economic development of the states. Because of that very reason, they are even more concerned about outcomes. As we move rapidly to an information and technical society, there is a growing concern for not only the basic literacy of our graduates but an increasing concern for their scientific and technological literacy.

Another reason for state involvement identified in the governors' reports is the failure of our accrediting agencies to include outcome measures in their review procedures. A final reason has to do with the general uneasiness of the public that our results have not kept pace with our costs. Cost containment is a serious issue of growing concern.

It is important, too, to know what elected officials think should happen in accountability. Certainly this affects state policy makers and state commissions of higher education. Going back to the governors' conferences that occurred in 1987 and 1988, they talked about the first step in accountability being clearly defining the mission and role of each college and university. In Maryland, with few exceptions, the mission statements of our campuses are not well focused, and one cannot measure much from what we said the purposes of some of the campuses are.

Part of the 1988 legislation directed the Commission to identify long and short range goals for higher education in Maryland. When I arrived in March, the Commission had spent many months listening to people in the state, and they came out with three long range goals, and one of those tells you something about both mission and accountability. Quality is one that we hear (we all say that quality is one of our goals in higher education), but they defined it very precisely as effectiveness of institutional results based on an institution's approved mission. And in this context, then, there are as many opportunities for quality for our various institutions as there are needs to serve our increasingly diverse population.

There were other themes that came out in 1987 and 1988 that you can see both in Maryland and across the country. Most prominently, aside from the mission, was an emphasis on the fundamental importance of undergraduate education. You see that driving the general focus of most of the assessment projects around the country, and I think that you will see that in Maryland as well. The Commission, in its process of setting long range goals and objectives, has made very clear the importance of undergraduate education.

Another theme was the desirability of using multiple measures to assess undergraduate learning, for the purpose of program and institutional evaluation. Still at issue is one that strikes fear in all of our hearts, namely, what results to make public. The public is asking for those results; they want to see our report card.

An idea gaining momentum is to adjust state funding guidelines to provide incentives for institutional improvement, while continuing base support. The Commission has begun to discount, particularly in the 4-year sector, what I call body count. Rather the idea is to continue base support plus inflation, with any new support directed and targeted. This is something that is very close to Governor Schaefer's heart, that we target new resources to those institutions that have either demonstrated improvement or have proposed ways to improve the undergraduate education or other parts of their mission. You will see more of that, I think, in Maryland.

I have suggested to the Governor and to the Commission that the campus has three responsibilities. One, that you're in the process of doing now, is developing statements of expected outcomes appropriate to the approved mission. Secondly, that the campuses have the responsibility to develop processes that yield evidence of the degree to which the outcomes are achieved. That's your responsibility. And the third is that the institution make appropriate changes as indicated by the assessment.

Test results can be an important part of assessment. As I go into the General Assembly and talk to the leadership of both the House and the Senate, they are talking about rising-junior exams, they are talking about all kinds of exams, as if we were in elementary and secondary education. So it's very important to educate our policy makers as we go through this process as to some of the differences between assessment and testing. Tests are not, as you know better than I do, the only basis for judging the effectiveness of our educational process. There is a wide range of other data available, including retention rates, graduation rates, transfer rates, placement rates, and alumni and employer surveys. I know this places a lot of burden on institutional researchers, but, in the long run, if we have assessment tied only to one test or two tests, I don't think we'll do as well, and I certainly know that your presidents don't want to approach it that way.

So, as I work with the Commission and legislators and the Governor, I will be talking about using more than standardized tests of basic skills to measure undergraduate education. That's where their major concern is—undergraduate education. If we evaluate undergraduate education solely on the basis of minimum competencies which happen in elementary and secondary education, again it contradicts the very purpose of what we're trying to do—improve education. And I think it's particularly important that we not do this given that our students have to live in a world of enormous change that requires skills related to critical thinking and continuous learning.

Finally, the most important thing that I've tried to talk through with the Commission and with the Governor and other elected officials, is that there is only one reason that you have assessment of undergraduate education and that's to improve teaching and learning. That's why it has to be done on the campus and not at the state level.

Taxographic Space: A Radically Different Paradigm for Information Management

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Third MdAIR Conference
November 17,1989

The reigning paradigm of information management is the tree. The logical kernel of this hierarchical structure is the subordinate relationship of branch to trunk. **Taxographic space** is a paradigm of information management based, not on a single generic subordinate relationship, but on multiple, independent coordinate relationships.

In a computer, a subdirectory is subordinate to its parent directory; in a filing cabinet, a subfile is subordinate to its parent file. Coordinate relationships exist only as a by-product of multiple subordinate relationships: if two branches are subordinate to the same limb, then they are coordinately related by their common superordinate. The subordinate relationship, as the primary structural principle of the tree, is currently the paradigmatic relationship of information management.

Coordinate relationships are more common and more useful. In any table, spreadsheet or database, headings along the horizontal such as **quantity, unit price**, and **color** identify types of information that are neither contained in nor dependent upon each other. They are independent, mutually exclusive types or classes of information, and hence are related coordinately, not subordinately. Although we do not usually think of them as such, a table's "headings" along the vertical—be they inventory items or social security numbers—represent independent, mutually exclusive classes also. When such classes refer to people, they typically contain only one individual apiece; nevertheless they represent a set of coordinate classes. All such tables, spreadsheets and databases organize information by separating it according to two different classifications, each one spread out along one spacial dimension. The classes in each are independent, coordinate classes; the classifications themselves are independent, coordinate classifications.

This common two-dimensional, double classification structure, commonly called the table format, has been used freely to organize single units of information. Each block of the typical table, spreadsheet or database contains only a single item – a price, a name, a number. For organizing larger units of information – be they documents, data or programs, whether on paper or on magnetic medium – this practical, effective organizing tool has been abandoned in favor of the tree structure. Yet the table format can be used as easily and efficiently to organize larger items of information as it is used to organize single items of information. The blocks of a chart can contain documents, data or programs just as easily as they can contain prices, names or numbers.

Presumably, the table format has not been used to organize paper documents because physical realities would make it impractical. Presumably, the table format has not been used to organize electronic documents because no equivalent to the vertical and horizontal spacial dimensions has existed within computer memory. This is no longer the case. Using the existing tools of subdirectories and some simple programming, multi-dimensional coordinate space can be reproduced within computer memory, creating two-, three- and higher-dimensional table-like structures that organize large units of information by classifying them simultaneously in any number of custom-designed, independent classifications. Because this space is defined by multiple sets of coordinate classes (or taxa), it is called **taxographic space**.

In Institutional Research at Frostburg State University, we have been using a three-dimensional taxographic space as our sole electronic working environment. For all our file storage and program development needs, taxographic space has entirely replaced the directory tree, providing us with an astonishingly simple, practical structure that lends itself naturally to configuration management, yet that is flexible enough to withstand major functional revision without endangering valuable electronic documents. This remarkably powerful tool can be tailored to any needs and created by anyone equipped with standard subdirectory capability and some elementary programming.

A Sample Taxographic Space

A two-dimensional taxographic space, like a two-dimensional table, requires two independent classifications of information. These classifications and the coordinate classes within them are chosen based on the kind of information to be organized and the purpose of that organization. In Institutional Research, we create programs to analyze data files and report our findings; therefore, one useful classification suited to our needs is that of filetype, using the coordinate classes **data**, **include**, **programs**, and **reports**. With the exception of the short programs needed to run the system, all our files can be separated into these four classes. A second useful way to classify these files is by subject or project. We use seven coordinate classes, including a miscellaneous class, which we will generalize here as **subject 1**, **subject 2**, etc. The table created by these two classification components is shown at the top of the following page.

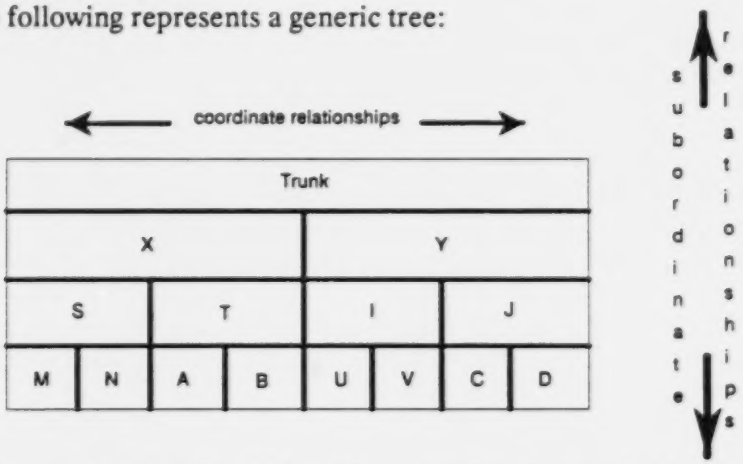
Since we operate as a production shop with programs, data and reports in various stages of development at any one time, we find it useful to classify our files in a third way—by production stage, using the classes **store**, **work**, **test**, and **complete**. The three-dimensional taxographic space thus created is like a four-story building, where the table above is the floorplan for each of the four floors, and where each floor is assigned one stage of production.

	Subj 1	Subj 2	Subj 3	Subj 4	Subj 5	Subj 6	Subj 7
Data							
Include							
Programs							
Reports							

With three independent classifications, tailored to our specific needs—consisting of four filetype classes, seven subject classes, and four production classes—112 (4x7x4) distinct file storage areas have been created. Each one represents a unique combination of three of these fifteen practical, functional, easily-remembered classes. The presence of a file in one of these storage areas indicates its filetype, its subject, and its stage of production; therefore, any file can be readily located knowing only these three things. Considering that a mere ten files per storage area means 1,120 files, and considering the complexity of a directory tree for such a number of files, the superiority of this system should be clear.

Creating Taxographic Space

The following represents a generic tree:



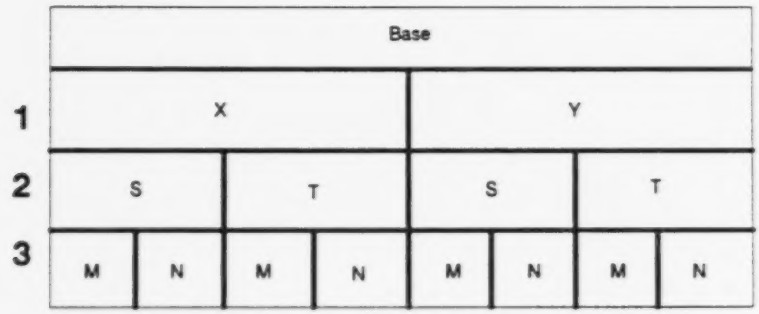
There are four levels of hierarchy, counting the trunk or (as in a directory tree) the root. The relationships between storage areas on different levels are the subordinate relationships. Coordinate relationships exist between storage areas with a common superordinate. Areas labelled with consecutive letters are related in this way. Note that more than one set of coordinately related storage areas can

exist on the same level. The otherwise random labelling is intended to illustrate the lack of other relationships and the uniqueness of each storage area.

In a paper-storage tree only the lowest level areas are generally used for storage. The rest are for structural purposes only, i.e., files **M** and **N** would be subfiles of **S**, which would be a subfile of **X**. The two storage areas would be identified by the full names **X.S.M** and **X.S.N**. The file **X.S** would not exist. In a directory tree all areas are typically used for storage, i.e., not only would the subdirectories **X.S.M** and **X.S.N** be used for storage, but the subdirectory **X.S** would be as well.

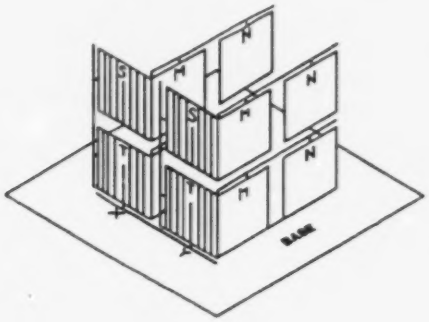
The severe limitation of this typical tree is that only one generic coordinating relationship is possible. The tree does not naturally lend itself to the multiple coordinate classification organization which has proven so useful in organizing single units of information. But there is a way to design a tree structure so that the subordinate relationships disappear, the coordinate relationships become primary, and any number of independent coordinate classifications arise.

In the tree shown, parallel sets of branches are added with each sub-level. As in the paper-storage tree, only the lowest level is used for storage space. The upper levels are for structural purposes only. Below each directory on level two (excluding the base level) are identical sets of subdirectories (**M** and **N**); below each directory on level one are identical sets of subdirectories (**S** and **T**).



This parallelism creates a taxographic space from a directory tree. On each level (except the base) there is one set of coordinate relationships and only one set of coordinate relationships. Since only the lowest level storage areas are used, each storage area is identified by exactly three labels, one from each level. Since there is only one classification per level, each storage area is identified by one coordinate class from each classification. In effect, each area is classified in as many different ways as there are levels, and each of these classifications is independent of the others.

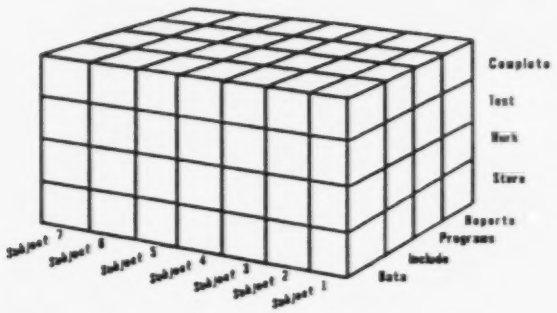
The figure below illustrates how the parallel structure of this example recreates a three-dimensional taxographic space:



The base provides a place to build and names the space as a whole. The first level directories (**X** and **Y**) provide the coordinate classes along one dimension, the second level directories (**S** and **T**) provide coordinate classes along a second dimension, and the third level directories (**M** and **N**) provide classes along a third. Although on the system level there are four **M** and four **N** directories and two **S** and two **T** directories, the practical organizing structure is the same as that produced by crossing these three sets of coordinate classes as in a table. A tree in parallel with two levels (excluding the base) creates a table; a tree in parallel with three levels creates a three-dimensional "table." The parallel tree, and hence the dimensionality of the taxographic space, can be extended indefinitely to whatever number of independent classifications is deemed necessary for the quantity and diversity of the documents to be organized.

Rooms in the Factory

The taxographic space that we use in Institutional Research can be accurately represented by the figure below. Each of these blocks is a file storage area iden-



tified by three subdirectories and the base, for instance, the low corner block nearest the reader is Base:[Store.Subject 1.Data].

The particular ordering of the classes on this map is entirely arbitrary. No order exists within the taxographic space, and the order given it for illustration purposes is only for convenience. Taxographic space has no equivalent to the inherent and unavoidable order of actual space, but it is not needed. A computer system can access any subdirectory instantly without the aid of alphabetical, numerical or any other kind of order.

Aside from the lack of inherent, fixed order, taxographic space effectively mimics actual space; therefore, it is simply an electronic version of the real space with which we are already familiar. This natural similarity and the familiarity that it naturally produces make it that much easier to picture, to remember, and to manage.

The similarity of a three-dimensional taxographic space to a building is real. Not only are there three independent dimensions as in real space, but there are separate storage areas, or rooms, bounded by the coordinate taxa as effectively as walls, ceilings, and floors bound rooms in a real building.

There are four identical floors, each containing files of one production class. Files are created on the work floor and are moved through the store and test floors until they are completed and moved to the complete floor. Because of this production process, this building bears more resemblance to a factory than a warehouse.

The seven subject classes divide the building into seven departments. Although certain files may be useful in more than one department, most will spend their lives within a single department. This is a direct result of the subject taxa used to create the space in the first place.

The filetype taxa form four halls that extend through all departments. Whenever it is useful to consider all the data or all the reports, regardless of department, this division of the space is needed. For instance, the data hall on the complete floor might be considered the most critical area and given the most security.

This space could be used by a single person with complete access to every room; it could be used by seven subject-oriented departments within an organization, each having access to one department. It could be used by three production-oriented groups, such as a production group (the work and store floors), a test group (the test floor), and a user group (the complete floor). The natural divisions of taxographic space make it ideal for such configuration management.

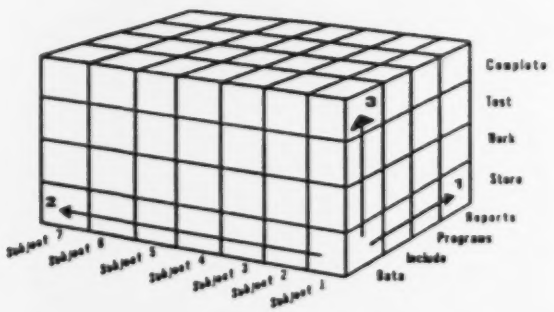
Creating Taxographic Commands

When accessing a given directory we often speak and think as if we were "in" that directory. Because of its great similarity to the actual space in which we live, this way of thinking is even more natural in taxographic space. Were we left to

manipulate the subdirectories ourselves, the required depth of the parallel directory tree (to four levels, counting the base, in this example) would make moving from room to room cumbersome, effectively destroying this spatial illusion and the practicality of taxographic space along with it. A new command that makes moving from room to room as simple as it is in a real building would restore both.

In a parallel tree the possible subdirectories on any one level are limited to some predetermined, unchanging small number. Also, since only the lowest level subdirectories are used as storage areas, every room always has the same fixed number of subdirectories. These fixed, predetermined parameters make it possible for a simple program to take care of all the otherwise cumbersome directory manipulations for the user.

This program acts as a new system command with a single parameter—one of the fifteen (in this case) classes. It determines which level the class parameter belongs to and changes the subdirectory on that level while leaving the other levels as they were.



For example, suppose the user is in the room Base : [Store.Subject l.Data]. The command might be "sd" (mnemonic for "set default"), and the parameter "reports." The program ascertains the current default directories for each level, determines that the parameter "reports" is a third level directory, and changes the default directory

from Base : [Store.Subject l.Data]

to Base : [Store.Subject l.Reports]. (1)

The command "sd subject 7" changes the default directory

from Base : [Store.Subject l.Data]

to Base : [Store.Subject 7.Data]. (2)

The command "sd complete" changes the default directory

from Base : [Store.Subject l.Data]

to Base : [Complete.Subject l.Data]. (3)

(Since this command is used very frequently, it is convenient to make it a "null command," i.e., by using either logical assignments or one-line command files, making it sufficient to enter the parameter only. For instance, "complete" is interpreted by the system to mean "sd complete", or more generally, "{null} <class>" is interpreted to mean "sd <class>".)

Each execution of this command moves the user through one dimension of taxographic space at a time. Since most moves would be to a closely related room, one execution would usually be sufficient; but at most three executions would move the user from any of the 112 (in this example) rooms to any other room. Because of the simplicity of the program, the move is accomplished quickly or instantaneously (depending on the user's share of CPU time).

Transferring Files

In order to complete the illusion of working within an actual three-dimensional structure and completely hide the cumbersome system level directory structure, one other command is needed—another copy command to replace the system level copy command that requires the use of the directory structure.

For instance, the command might be "cp <filename> <class>". This uses the minimum number of parameters, one to designate the files to be moved, and one to designate the room to which they are to be moved. The program works essentially like the user move, except it copies the files from the default directory to the target directory, rather than moving the user.

A nearly identical, but useful command could be programmed to actually move the file to another room, not just copy it. This is accomplished much faster than a copy by using the system level rename command to change the file's directory address. Where this is not possible, the file can simply be deleted from its original location after it has been copied to the new one. A format similar to the one above would be "mv <filename> <class>".

For the copy-move command, the current room must be the present location of the file to be copied. Like the user move, the copy-move command only moves files in one direction at a time. Since it is so easy to move within taxographic space, and since most files are moved in only one direction (from one floor to the corresponding room on another floor, or from one department to the corresponding room in another department), this presents no difficulty.

Many other commands are possible to enhance the system and adapt it to individual needs, but with the user move and the file copy-move, the system level directory structure is entirely hidden and the taxographic space is ready to use.

The Control Room

The programs that run the system—the user move, the file copy-move, and any others—cannot be kept inside the taxographic space proper. For this purpose a

special directory called **control** can be established. There may be only one of these, completely independent of the taxa, or there may be one per floor, or one per department. Our taxographic space in Institutional Research is spread over the University's computer resources in such a way that each floor is password-protected by the system and operates independently of the others. There is a control room on each floor. When a user moves to another floor, control is passed to the control room on that floor.

Linking Software to Taxographic Space

Although taxographic space is valuable by itself as a storage and management tool, it is far more powerful when other software is linked to it. This is possible even when software acts entirely on the default directory by means of short batch or command files.

These command files are called by the user, and they in turn call the software. They set parameters or copy files before or after the software is called, acting as an interface between the taxographic environment and the environment that the software expects. In the worst case, either they copy files from their proper rooms into some predetermined room where the software expects to find them or they copy files from where the software put them into their proper rooms. For software that allows the user to submit various default directories as parameters, the command file takes care of this. On systems (such as PCs using MS DOS) where subdirectories can be temporarily renamed to a form that the software expects, they perform this function.

When software allows access to the directory tree, taxographic space can also, of course, be accessed, albeit, in a cumbersome manner.

Software could conceivably accept the user's coordinate classes along one or more dimensions as part of its installation or as a parameter file, or it could read them directly from the parallel directory tree. Although the number of dimensions and the names and number of classes in each would vary from user to user, the parallel directory tree provides a standard far more practical than the nonparallel tree currently in use.

Higher-Dimensional Taxographic Space

Whenever more than three independent classification components are necessary to effectively organize a user's files, the resulting taxographic space is more than three-dimensional. Just as the second dimension is created from a single row by adding identical rows, and just as a third dimension is created from a single floor by adding identical floors, so the fourth dimension is created from one building by adding identical buildings. An example of a fourth set of taxa would be geographic divisions for an organization spread over a broad area and dealing separately with subdivisions of that area. The fourth dimension simply creates a row of four identical buildings, each containing files pertaining to one geographical area.

A five-dimensional space would contain identical rows of buildings, i.e., a table of buildings. A six-dimensional space would be a building in which each room is itself a building. This process can be continued indefinitely as needed.

Compound Taxographic Space

Several taxographic spaces may be needed to organize separate but related kinds of files. For instance, one building may be needed for programming, whereas another may be needed for writing that uses the results of the research done in the programming building. In order to link these two buildings so that both files and users can move between them, a special room accessible to both, but outside the regular taxa is needed. A subdirectory called the **dock** which can be reached by both the user move and the file copy-move can link these two or any number of buildings in this way.

The Taxographic World

The specific configurations possible within the paradigm of taxographic space are as unlimited as the number of different buildings that it is possible to build out of bricks. Yet unlike the tree paradigm in which disorder is all but guaranteed and confusion increases along with complexity, taxographic space possesses a natural orderliness – an orderliness with which we are already familiar and in which it is difficult to get lost. It is conceivable that a large compound of linked multi-dimensional taxographic spaces could become confusing; but because of its natural similarity to the real world, it is as easily mapped, and because functional, work-related taxa create the space, the layout is easily remembered.

Whether a small two-dimensional storage floor, a compound of three-dimensional buildings, or a compound multi-dimensional complex analogous to a city, all taxographic space is founded on the simple principle of multiple coordinate classifications utilized by means of the parallel directory tree and automated directory shifting. This inherent quality provides a universal standard that ensures that any two taxographic spaces can be linked and that anyone familiar with one taxographic space will be comfortable in another.

Taxographic space is a tool as fundamental as bricks and mortar and with as many possibilities.

Selecting Tools for Institutional Research

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Fourth MdAIR Conference
November 9, 1990

Introduction

The medium in which the institutional researcher works is information – information about students, faculty, staff, finances, facilities, credit and noncredit programs and courses, regional and national trends, alumni, fundraising – to name just a few kinds. The extent to which the institutional research professional can readily access, manipulate, interpret, and present information on behalf of a variety of constituents will largely determine his or her value to the institution. Fortunately, there are many tools available to assist the research professional in handling information. Which tools are best for a particular office depend on the configuration of information needs, the audience for the information, and available resources.

Much of the information handled by an institutional research office is numeric. One difficulty is that the sources of the original raw data are seldom under the control of the research office. For example, in the institution's database containing information about students (the student information system or SIS), the data entry and updating may be controlled by admissions and registration offices, and the programming by the administrative computing office. It was not uncommon in the past for institutional research to not even have read-access to the SIS to look at the data; the research office had to rely on printouts of reports prepared by the computer center's programming staff. Now, most institutional research offices have direct read-access to the SIS files, but the problem of ensuring data integrity remains.

The student information system, the personnel database (Human Resource System or HRS) and the financial database (Finance Resource System or FRS) are considered to be "live." That is, their data are frequently being modified and updated. For the most part, the institutional researcher will work from files of data that were extracted from the live databases on a particular census date. These "frozen" files are snapshots of the live systems as of the census date. The most common census dates are mandated by state or federal reporting authorities, such as "ten day" or "third week" official enrollment reporting dates. Additiona! snapshots or frozen files will be extracted for a variety of other reporting and analytical purposes. It is understood that the data change after the census date (students withdraw, courses are added, new personnel join the institution), but the frozen files are regarded as official and used for the majority of institutional research ef-

forts. Many reports to the state and federal government are based on the fall census, so it is especially critical for the custodians of the live databases to have them complete and accurate by the freeze date.

Once raw data are available, either from frozen files as described above or from other sources (other campus offices, regional or national databases, surveys), the institutional researcher must be able to manipulate or "crunch" the data into meaningful information. Analysis of data may range from eyeballing tabular presentations to performing sophisticated statistical techniques. Likewise, the tools for working with data are varied.

The following sections present an overview of the kinds of computer software useful in institutional research. Although specific products are sometimes mentioned, be aware that the field of software development is constantly changing. Well-known products are updated and new products become available at a bewildering rate. One should be prepared to do a lot of investigating and shopping before purchasing any software.

Analytical Software

Statistical packages are available for both mainframe and personal computers. Although with very large data files mainframe packages may be more efficient, increasingly analysis is being done on PCs with downloaded mainframe data sets. These analytical packages may perform everything from simple descriptive statistics, such as frequency distributions, means and medians, to more sophisticated tasks such as multiple regression, MANOVA, and discriminant and factor analyses. Factors to consider in selecting a statistical package include data management needs, data interchange capabilities, ease of use, documentation and support, available computer resources, the range of statistical procedures included, efficiency, and cost.

The two most widely used statistical packages in institutional research are SPSS (SPSSx for the mainframe and SPSS/PC+ for the PC) and SAS, both mainframe and micro versions. Other, less widely used packages include SYSTAT (flexible, truly interactive and good for exploratory analysis, accurate and a good value), Statgraphics (great graphics, easy to learn, but limited data storage and handling), and BMDP (the micro version is a minimally interactive replication of the reliable mainframe package). Although SPSS/PC+ is menu-driven, both SPSS and SAS generally take some time to learn to use. Some experienced SAS and SPSS users consider themselves "programmers" due to the coding complexities that can arise, although "true" programmers would probably argue that contention!

Generally, when using a statistical package, a command file is constructed, which is run against a set of data that is either embedded in the command file or is in a separate file. The command file directs the package to perform all the indicated manipulations and analyses, and a result file is generated. You may ask for complex data manipulations and for many different analyses to be performed in the same run. These packages also enable the user to add titles and labels, which are

helpful in deciphering a lengthy result file. Both SAS and SPSS also have report-generating procedures. SPSS/PC+ combines fast performance, a great editor, excellent data interchange capabilities, and the best documentation in the business; PC SAS has most of the tremendous data-handling capability of the mainframe version but at a cost in speed. SPSS has an advantage in that it can be purchased, while SAS must be leased. One small advantage of SAS over SPSS is that it allows for the access of several data files at once during a run, while SPSS requires an additional step of first creating system files. People's preferences for SAS or SPSS tend to reflect which package they learned first, rather than the superiority of one to the other. Both are very powerful and valuable resources, well worth the investment in time to learn them. Whichever is chosen, a statistical software package constitutes a nearly essential tool for the institutional researcher.

Microcomputer Software

In addition to a powerful statistical package, institutional researchers may benefit from a variety of microcomputer software including data management, spreadsheet, graphics, mapping, word processing, and desktop publishing packages. Another package useful for heavy micro users is a utilities program, with the Norton Utilities the best known. Utilities software is useful for directory and file management as well as for diagnosing and correcting disk-related problems, such as overwritten or erased files, a bad file allocation table, or a trashed root directory.

Data Management. In situations where the institutional researcher must enter or store raw data, a microcomputer database management package is valuable. Just as an information system on a mainframe computer system stores, defines interrelationships between, and retrieves data, a database application for the PC allows data to be stored, retrieved, and manipulated, with elements and their relationships predefined.

The entry and storage of survey response data is a popular use for database packages in institutional research. Many of the packages have features to allow you to create a data-entry screen, which enables you to enter raw data by tabbing between different fields on the screen that identify the variables. To facilitate entry of survey data, the data-entry screen can be constructed to look like the survey questionnaire, and each field can be defined to only allow entry of valid responses, i.e., entries outside of the choice set will not be accepted. This greatly reduces the incidence of data entry keying errors. To anyone who has ever entered series of numeric data onto flat files, the advantage of a data-entry screen will be obvious!

An important feature of database packages is their ability to upload and download files. Selected data from the database package may be extracted into a file which can be imported into a spreadsheet application or statistical package for further manipulation and analysis. Likewise, data from other sources (a mainframe tape file, a spreadsheet, etc.) can be imported into the micro

database package. This data interchange capability, or ability to read, write, and transfer data stored in a variety of formats from other sources, is an essential feature for maximizing the usefulness of microcomputer applications software. Data transfer between micro packages is improving as new releases of popular applications are issued. For example, the popular spreadsheet program Lotus 1-2-3 release 3 provides full access to dBASE files from within the spreadsheet without having to convert the dBASE files to 1-2-3 worksheet files. You can add new records to the dBASE file or even create new dBASE files from within your spreadsheet. All of your software packages should have interface capability.

The most popular database management package in institutional research is probably Ashton-Tate's dBASE series, although Microrim's R:base and Borland's Paradox have their adherents. Database packages can be somewhat complicated to use compared to other micro applications; however, newer releases are often menu-driven facilitating use by nonprogrammers. These packages tend to take up a lot of space on your hard disk, so you should carefully consider your needs before purchase.

Spreadsheets. Spreadsheet applications are probably the most common type of PC package used in institutional research. Spreadsheets are similar to financial ledger sheets, ruled into rows and columns. The rows and columns form cells into which a number, formula, or label may be stored. Spreadsheets are useful for basic tasks such as storing and manipulating small data sets, performing some simple descriptive statistics, and presenting data in tabular form. Most also have graphic capabilities. Data manipulation may involve physical movement (adding, deleting, or moving columns and rows of data) or performing mathematical operations.

The power of spreadsheet applications comes from the use of mathematical formulas. The formula referring to one set of cell entries may be copied so that it applies to another set. Very elaborate models may be constructed in this way, making spreadsheets ideal for "what-if" investigations. Model assumptions can be varied and the impact on various dependent variables immediately discerned. For example, spreadsheets are often used for enrollment projections and financial planning models.

Complex command sequences can be automated by the use of macros. A macro is a sequence of recorded keystrokes or commands that the software executes automatically. Macros are stored with the spreadsheet in which they are created, so you can have different macros for each spreadsheet. Sophisticated use of macros enables construction of applications that can be used by others with very little knowledge of the parent program.

The integrated graphics capability of most spreadsheets is useful during analysis. Generally, line, bar, X-Y, pie, area, and high-low graphs are available. Viewing these while you work with the data in the spreadsheet can highlight relationships and suggest further analysis. Some spreadsheet packages, such as

Borland's Quattro Pro, offer high quality, flexible graphics useful for presentation purposes as well.

Lotus 1-2-3 is by far the most well-known spreadsheet application, although several other powerful packages, such as Quattro and Microsoft's Excel, are gaining favor. Newer packages employ the mouse-driven graphic interface made popular by the Apple Macintosh. One advantage of using Lotus is that because so many people are familiar with it, it is easy to get help. Again, however, with high quality products the advantages of one over another tend to change with each update, and personal preferences and prior experience often will be decisive in making a selection.

Presentation Graphics. Although some of the spreadsheet packages have graphics capabilities, more refined graphics may be desired for final documents and presentations, and so a more sophisticated graphics package may be warranted. With dedicated graphics packages, data manipulations are limited, but the graphics are more powerful and versatile, allowing for more text, labels, symbols, font choices, graph types, and overall design flexibility. Packages such as Ashton-Tate's Applause II come with a "gallery" of clip-art images that can be used as pictures or as backgrounds to enhance presentation graphics. Perhaps more importantly, the final product is generally of a higher quality than with some of the spreadsheet graphics, although the newer spreadsheet releases are closing this gap.

Packages such as Harvard Graphics and Applause II can generate a variety of high quality graph types on paper, overhead transparencies, or slides. Being menu-driven, these packages are easy to use and high-quality products can be produced very quickly, even by a beginner. However, the ease with which graphics can be created on these packages is a potential danger to the unsophisticated user. Knowing when a graph should be used, deciding what type of graph is appropriate, and creating graphs that do not distort the data, are acquired skills.

When geographic analysis is important, a special type of graphics package is called for. Mapping or geographic information system software, such as Strategic Mapping's Atlas series, enable the institutional researcher to display a variety of data by census tract, zip code, minor civil divisions, districts, counties, states, nations, or other geographic units, depending on the cartographic boundary files available. Editors allow the user to define other boundaries as well. U.S. Census and other data associated with geographic units are available on diskettes, enabling the user to easily display demographic variations by geographic location, to support an environmental scan, for example. The institutional researcher can also create maps of college-generated data. For example, a college might map its enrollment yield rates by state or zip code to help target marketing efforts, suggest transportation needs, or identify sites for extension operations.

Word Processing. Word processing packages allow you to type, edit, format, and print textual information. The word processor is to the typewriter what the spreadsheet is to the calculator! Many word processors include spell checkers, dictionaries, and thesauruses, making writing less cumbersome. Drafts can easily be revised, avoiding needless retyping.

Newer releases of the more popular word processing packages include some desktop publishing features, and facilitate the importation of tables and graphics from spreadsheets and other packages.

Desktop Publishing. A desktop publishing package picks up where most word processors leave off, by providing a much greater range of text enhancement, type composition, and page layout capabilities. Typeset-quality documents can be produced without the traditional method of pasting up galleys and artwork on a mechanical layout. Pictures and drawings from graphics programs and image scanners can be added, as can tables from spreadsheets and databases. For example, a publication about recent graduates might be identified by a symbol of a mortarboard, and data tables or graphs from a follow-up survey might be interspersed with columns of text. Text and graphics can be composed interactively on the screen and viewed before you print them. Stylesheets can be saved for newsletters and other documents that you plan to issue more than once, so the design need be created only once. For example, once you decide on a "look" for a research brief, you need only load your wordprocessing file into the publisher and the previously saved stylesheet file instructs the publisher how to format the document. Desktop publishing packages are generally not word processors, though some text manipulation is possible. Usually, a word-processing document is edited and proofed and then loaded into the publisher.

Desktop publishing applications in institutional research might be limited to reports prepared for very special audiences (governing boards, legislators) or for producing survey questionnaires. Desktop packages allow you to create very polished and professional-looking products, which will catch the eye of the audience and reflect well on the institution. Because of the increasing sophistication of word processing software, however, a separate desktop publishing package may be considered more a luxury than a necessity for the institutional researcher.

Equipment

For the most part, this discussion has been from the perspective of an IBM or IBM-clone user. The particular packages discussed may not have versions for Apple computers, and software written exclusively for Apple machines has not been mentioned. In spite of Apple's strengths in several areas, cost and lack of compatibility with existing systems keep it a far second in popularity in institutional research offices.

As the IBM world moves to emulate the features that make the Apple computers so attractive, more and more applications are being designed with a graphic interface for point-and-click mouse use. The mouse allows you to freely move around the screen and point to and select menu options or other features. It is particularly useful for graphing and desktop publishing.

You will need a system with a hard drive large enough to handle the kinds of applications you plan to use. Storage requirements vary from package to package, and should be considered when purchasing both a system and the software. Memory is the next consideration, as some of the more sophisticated packages take a lot of memory to run.

You will need access to a printer from your PC. A laser printer produces high-quality output quickly and quietly. There is little point in having some of the top-of-the-line graphics packages or desktop publishers if you don't have a printer that can take advantage of them. A color plotter is also useful for producing overhead transparencies for presentation purposes.

Another useful peripheral to have is a modem. A modem allows you to connect your PC to other computer systems through telephone lines. You could have direct communications to on-line library catalogs, national databases, or communications networks such as Bitnet or Internet. These kinds of connections to the outside world are not only valuable, but a lot of fun!

Conclusion

In deciding which kinds of software you need and which particular packages you want, one of the most important resources to take advantage of is colleagues in other research offices. Find out what packages others are currently using, how well they are doing the job, and how difficult they were to learn. Also speak with the people in your institution's computing offices. They are generally eager to discuss new software; in fact, the hard part is often getting them to stop talking about it! Finally, visit your library, a bookstore or newsstand. There is a plethora of magazines aimed at the PC user, as well as numerous books, manuals, and guides.

Particular attention should be given to how difficult packages are to learn. Assessing the learning curve is important in making decisions to upgrade to a new version of an existing package, as well as in initial purchases. While applications software revolutionized institutional research, providing the greatest single leap in office productivity in institutional research's short history, researchers must avoid becoming captive to an obsession with the latest, state-of-the-art tools. You can easily devote excessive office time to evaluating new software and discovering bugs in the newest releases. In reaching decisions to adopt a new package or upgrade an existing one, the impact on office productivity should be carefully considered. In general, such transitions should be made only when the new product offers improvements that will have a substantial return on office efficiency. However, once you adopt new packages and become accustomed to each new feature of these valuable and evolving tools, you won't know how you got along without them!

When an Institutional Researcher Needs a Statistical Package - and More

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Fourth MdAIR Conference
November 9, 1990

Introduction

SPSS is most commonly used by institutional researchers because of its marvelous statistical capability. It is an extremely powerful but easy to use tool in survey research, enrollment forecasting or in any analytical study requiring statistical analysis. I make extensive use of SPSS for these purposes, but I also find it to be an invaluable tool for managing data files, and to answer ad hoc requests for data or information from faculty, staff and administration.

Why SPSS

I use SPSS as a data and file manager because it is flexible and easy to use in our computing environment. We do not have a relational database. Our data reside on two clustered VAX 6200s, and we use the Series "Z" administrative software to manage student, employee, and financial data. The system is very good for data input and data processing, but outside of standard COBOL-written production reports, it has only a limited report writer (the "Z" writer). This tool cannot handle report requests that include recurring data elements, such as grade point averages or the previous school of a transfer student.

How to Perform the Job

Rather than using mainframe utilities, I have chosen instead to extract ASCII data files that I can use with SPSS. These extracted files are created on the same day as all the official reports that go to the board of regents, as well as to state and federal governments. Unlike the files on the VAX, these extract files never change. They are frozen files that can be used to give official answers to questions no matter when they come up in a semester, or even five years later. Currently I have seven of these extract files for each semester or, as in the case of employee data, for each fiscal year. They include bio-demographic and academic data on students; longitudinal data for tracking student retention, attrition, and graduation;

data on student grades; data on degrees granted; data on class size; and employee data. Current versions of these files are stored on disk, while previous ones are backed up to tape, which can be accessed quickly.

SPSS is particularly great in the data selection process. Using the SELECT IF statement, it is possible to cut the data on any existing variable. Using COMPUTE, RECODE and DO IF statements, I can answer questions that require the creation of new variables, or new combinations of existing ones. Depending on the nature of the request—and the preference of the requester—I use the LIST command, the REPORT procedure, or the TABLES option to format the results. I create graphics on a microcomputer using Harvard Graphics, although this requires re-entering data. I have found that many people won't read data but they will look at pictures. I also plan to use the WRITE procedure to send data sets to users who are comfortable working with the actual data. And, if we ever get to decentralized data processing, SPSS will be the tool of choice for me. I hope to place the current versions of these data files in a directory that can be accessed by other users trained in SPSS so they can read (only) the data and do their own analysis and format their own reports. Their tasks will be made much simpler by the ease with which one can learn SPSS.

Benefits and Results

SPSS allows me to read the data files, select the data needed to answer the request, and format the output for a formal report. In some cases, the results are printed and then sent to the requesting party. In other cases, I simply E-Mail the results to their terminal or PC for them to print-out or use as they see fit.

Using the SPSS MATCH FILES procedure to link data files from two different semesters is particularly helpful in doing longitudinal studies of students—following them from one semester to another—tracing their enrollment patterns. For example, I use MATCH FILES to compile a list of the social security numbers of students who fit a certain profile (G.P.A. and credit hours attempted) to print mailing labels for a nonreturning student survey. I am also working on a way to bring several semesters of the same data file together in one active file. This will facilitate the creation of aggregate variables that can be used in the TABLES procedures to show trends over several semesters. (In this case, showing the change in the number and percent of black undergraduates enrolled from 1984 to 1989.)

There are other tools available to do similar statistical procedures, but none are as easy to learn and use as SPSS. I could use COBOL programs, but that takes much too much time. Some requests can be answered using DEC VAX Datatrieve, but that requires excessive CPU time. SPSS provides a quick and easy way to access data files, select variables, and format high-quality reports.

Staff Attitudes Toward Outcomes Assessment

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Fourth MdAIR Conference
November 9, 1990

Abstract

The purpose of this study was to determine staff attitudes and preferences toward outcomes assessment in Maryland's public, undergraduate institutions. The data were collected in fall 1989. Over 400 chief academic officers, division chairs, and faculty from 26 two- and four-year institutions were surveyed.

An analysis of the data indicated the following: (1) Four-year faculty and administrators were less positive than two-year staff about the value and feasibility of outcomes assessment. (2) Although there was not active opposition among either segment's faculty and staff to assessment, there was considerable lack of knowledge and suspicion of the program. However, means of the responses to questions dealing with value were on the positive side of 3.0 on a five-point scale. (3) Faculty and staff in both types of institutions were less sanguine about the feasibility of assessment; the means were near or below 3.0 for most groups. (4) There was general agreement about those indicators which should be assessed; in general faculty and administrators agreed that the most important measures were employer satisfaction and transfer success. Staff in both types of institutions did not like rising-junior examinations or graduate earnings indicators. (5) There was overwhelming agreement that results of assessment should be used to improve curricula and instruction. However, only 57 percent thought that assessment would improve instruction—supposedly the major reason for its imposition.

These results and others suggest that faculty and staff are relatively neutral about the idea of outcomes assessment. One gets the sense when viewing the statistical information derived from 76 questions and from volunteered comments that the major concerns rest with the methods of implementation and use of the data. Much of what faculty and staff would like to have assessed are already measured by many colleges. The data also suggest that faculty need to become actively involved in what is likely to be an expensive program in terms of dollars and time.

Summary - Attitudes Toward Outcomes Assessment

The return rate for this study was 77 percent, despite the fact that some respondents reported that the survey took much longer to complete than the projected fifteen minutes. This fact may attest to the interest the topic of outcomes assessment has for the selected faculty and staff in public, undergraduate education in the state of Maryland. Respondents did not hesitate to speak out on the topic, even when the questions did not call for their specific answers. Seventy-one percent of respondents provided unsolicited comments or lengthy narratives on their returned survey forms. The tenor of the responses was one of concern about the issue, its implementation, and its impact. Whether the comments were positive or negative, they were clearly reflective of deep thought and strong emotions.

The overall question which this study attempted to address was, "What are the attitudes and preferences of the staff toward outcomes assessment?" Most of the answers were neither dramatic nor unanticipated.

On the whole, respondents saw outcomes assessment as inevitable. Whether or not individuals saw it as needed, they did see it as difficult and, as one respondent said, "fraught with problems." Some questioned whether it could be done in a fashion which would truly benefit students, and others said that it clearly could not. Most of the other comments seemed to play into this theme: "If assessment is to be done, do it right and make it count for something."

Respondent Ratings of Value and Feasibility of Outcomes Assessment
Means, Five Point Scale

	Overall	Faculty	Division Chairmen	Chief Academic Officers
Value				
2 Yr. Institutions	3.4	3.3	3.4	3.9
4 Yr. Institutions	3.2	3.2	3.1	3.4
Feasibility				
2 Yr. Institutions	3.1	2.9	3.3	3.3
4 Yr. Institutions	2.6	2.6	2.7	2.3

Summary of Results
Elements of Outcomes Assessment

Category	Statement	Level of Agreement
Indicators	Transfer Success	91%
	Employer Success	90%
Use of Results	Revise Curricula/Instruction	82%
Impact	Increase Public Confidence	58%
	Improve Quality	57%
Problems	Results Misunderstood	72%
Plan Design	Broad-based Faculty Groups	77%
Receive Results	Faculty	92%
	Campus Administration	80%
Purpose	Improve Instruction	88%

Value and Feasibility

Respondents saw some value to the implementation of outcomes assessment but not a great deal. An overall mean of 3.3, only slightly into the category of agreement, is not an overwhelming mandate for the process. Moreover, the mean for the factor of feasibility was only 2.9, toward the disagreement side of the scale. It may be of some value, but it may not be possible to do it. Two-year staff had higher means; four-year staff were less favorably inclined.

The most frequently mentioned experience which influenced attitude formation was that of teaching. Respondents stated that outcomes assessment has value when the process parallels the goals and processes of teaching. Respondents expressed concern with the product of the educational system. Students were not where they needed to be in terms of content knowledge, basic skills, and higher level skills. In reference to these concerns, respondents saw outcomes assessment as being necessary for the improvement of education.

Where outcomes assessment was perceived as conflicting with accepted goals of teaching or education, it was seen as being of little use, a practice in futility. For example, if the wrong things were assessed, if they were assessed in an invalid way, if the results were improperly used, then the process was of little worth. When respondents recounted such events from their own experience, they indicated a more negative attitude toward outcomes assessment.

Coupled with little experience or negative experiences, there were repeated references to publicized assessment efforts which were seen as examples of ineffective practices. The outcomes assessment system in place in Florida was pinpointed as causing more problems than it solved. Similarly, the Maryland competency requirements for graduates of the secondary school system were cited as doing little to improve educational outcomes. Expressions of these feelings were reinforced by many statements of mistrust toward politicians, state agencies, and college administrators who may push for image-building outcomes, may use results to point fingers at "wrong doers", and generally may not conduct the process in a manner tending to improve instruction. Even those who expressed a belief that assessment is needed could not hide an undercurrent of concern.

Indicators

The respondents were accepting of many specific indicators of outcomes. Most favored were the typical graduate follow-up indicators of transfer and job attainment. Although acknowledged to be difficult to validly measure, indicators of critical thinking, student involvement, and attitude change were also highly ranked. Faculty and administrators tended to choose those indicators which were most closely linked with cognitive, affective, and experiential outcomes of the educational process in which they were involved.

These same respondents indicated that rising-junior exams were not appropriate. Narrative comments expressed the belief that specific measurements were often misleading and open to too much misinterpretation. Although they saw many measurements as pertinent, they also cautioned against investing particular ones with too much importance.

Use and Impact of the Assessment Results

By far, and regardless of role or type of institution, respondents expressed the belief that assessment results should be used to improve instruction and evaluate the effectiveness of the institution. The data and analyses are tools which allow those responsible for the educational process to make appropriate revisions and decisions. This process should be carried out in an objective fashion, and the results should be made public. The danger of misinterpretation exists and should be guarded against.

Although over 80 percent believed that the results should be used to revise programs and curricula, fewer than 60 percent agreed that there would be an improvement in instructional quality or that there would be an increase in public confidence because of outcomes assessment. The desired impact would not be attained. This disparity seems parallel to the difference between perceived value and feasibility. It attests to the repeatedly expressed cautions about misuse of data, lack of validity, political motivations, mistrust, and cynicism.

About a third of the respondents went even further to indicate that outcomes assessment would trivialize higher education and threaten academic freedom. This is not a majority of the respondents, but it can be inferred that there is a group of faculty and administrators who will not enter the process anticipating positive outcomes. These feelings were more prevalent among faculty and chairmen of four-year institutions.

Problems with Outcomes Assessment

This tone of doubt continued when respondents indicated what they perceived to be the problems associated with outcomes assessment. Danger of the results being misunderstood was the most highly rated problem, and application of statewide measures to a diverse set of institutions was a close second. Faculty and chairmen were more concerned with being misunderstood, while chief academic officers were more concerned that statewide assessment programs did not fit particular institutions. This second concern was reiterated when over 80 percent agreed that assessment methods should be related to institutional goals.

Preferences about Outcomes Assessment

Respondents would prefer that assessment plans be designed by broad-based faculty groups; that assessments include basic skills, higher order skills, general education, and subject matter skills; that the results be reported to faculty and campus administration; and that the results be used for instructional improvement.

Faculty of two-year institutions seem to want assessment of basic skills and plans designed by broad-based faculty groups; faculty of four-year universities look for assessment of higher order skills and plans designed by department faculty. These differences may be related to differences in institutional goals and organizational patterns in the two types of colleges.

Political pressure was a force which made faculty and chairmen hesitant about the usefulness of the process and may have contributed to the perception by these same groups that the whole endeavor is artificial. In general, however, there appeared to be no strong feelings about the value and feasibility of outcomes assessment. The strongest feelings were reflected in reference to specific indicators, the use of results, the need to relate outcomes to goals, and faculty role in the design of assessment plans and receipt of results.

Staff of four-year institutions tended to be less accepting of outcomes assessment, as shown in lower means for value and feasibility and lower level of agreement on many specific items which pointed to positive results.

Administrators valued outcomes assessment more highly. They generally were more inclined to include specific indicators, except for rising-junior exams. They were more in favor of making results public and using the results to impact

funding. Administrators viewed the impacts of outcomes assessment more positively than other respondents and, in general, were more willing to become involved.

In summary, respondents indicated a willingness to participate in outcomes assessment, although at times participation was seen as a matter of no choice. As one respondent graphically put it, "Outcomes assessment is another bureaucratic albatross around the neck of faculty."

Conclusions

From an overall perspective or view of the descriptive profiles given above and from the detail of data analysis, it is clear that neither faculty nor administrators are highly enthused about the implementation or effects of outcome assessment. There were no mean scores above 3.9 on any question concerning feasibility and value. Moreover, the only indicators that received scores equal to or greater than 4.0 were critical thinking, employer satisfaction, and transfer success. The latter two are more often than not measured informally or formally by most institutions. The former—critical thinking—is enjoying a lot of popularity in decisional circles as an important learning goal and assessment houses such as Educational Testing Service and American College Testing are involved in the development of tests for measuring critical thinking and problem solving.

There was concern among the respondents that assessment would follow existing patterns—that is, focusing on "easily quantifiable" outcomes. For example, several expressed fear that outcomes assessment might lead to "teaching to the test." Only three-fifths of the respondents believed that important learning can be tested by paper and pencil tests, the most prevalent form of testing. A level of distrust and concern that data would be misused was apparent in comments and the large numbers who agreed that the results are likely to be misunderstood. Respondents reiterated that the intended use of data is not clear. They stated that the "results will be misused," even "...used to punish."

However, nowhere in the descriptive profiles is there evidence that either faculty or administrators are indignant or highly fearful about outcomes assessment. While negative responses to open-ended questions existed, there were also a substantial number of positive responses. This finding is consistent with the thrust of some earlier studies which found faculty fearful of outcomes assessment, but satisfied with some of its impacts.

Implications

Based on the almost neutral feelings about values and feasibility and concerns about what will be measured, it appears likely that the implementation of outcomes assessment (at least in a meaningful rather than "artificial" way to use one respondent's language) is likely to be slow. The integration of these procedures into the culture and operations of institutions will be slow and nonpervasive.

At present, the process is externally motivated and it is likely to remain so until staff develop stronger values in regard to it.

On the other hand, there probably will not be strong opposition to processes which are set in place. If dictated by governing boards and administration, practices may be accepted as a fait accompli. However, they will not be endorsed nor initiated by the staff themselves. The benefits of the process will be minimized and will focus predominantly on external uses.

The theory of cognitive dissonance may operate in such situations. Holding a neutral value toward outcomes assessment yet participating in it by virtue of external requirements will result in dissonance. Resolution will be achieved by either a change in attitude or continuing need for incentives to operate in a field in opposition to a held value.

Legislative or state board mandates in Maryland appear to recognize the validity of respondents' concerns that assessment should be related to institutional goals. In Maryland as elsewhere, institutions are being given the opportunity to develop their own assessment plans. This should provide them with the chance to reflect on and reinforce institutional goals. This conforms to the National Governor's Association's 1986 *Time for Results* recommendations for colleges to link mission statements with the assessment process.

In implementing outcomes assessment, at both state and college levels, attention should be given to creating a vision or belief in the integrity of the system. Written comments more than the statistics suggest that faculty and administrators are more than a bit cynical about the assessment process, in particular what will be measured for what reasons. For example, it was noted that "The real value of education can't be measured." And one respondent admonished against "equating popularity with effectiveness." Another warned that "We will test only those things that are easy to test." Another questioned "Who will develop bias-free testing?" Another cynic suggested that administrators are more interested in headcount and consumer satisfaction. "Generally we will assess the least important aspects."

Concerns about the analysis of data should also be taken to heart by administrators of outcomes assessment. About 72 percent agreed that the results are likely to be misunderstood. And some respondents were concerned that colleges would "hide problems and only promote the good." Warnings were issued not to allow administrations to manipulate data. "Administration should have little role in interpretation; they are too vested to be unbiased."

Assessment plans should be developed with the purpose of instructional improvement in mind and faculty will need to be intimately involved in the plan development, selection of indicators, and interpretation of results. Instructional improvement will require meaningful data at the level of instruction. Institutions should look at what data they will need in order to impact directly on instructional processes.

There may need to be some "back peddling" to get faculty input into selection of indicators and development of plans. However, the level of agreement on these areas is such that significant conflict should not be expected. As faculty have input, they will also need to take action on the results. They will need to render responsible judgments based on the data they receive. Resources adequate to implement the changes must be available.

Considering the level of support assigned to the value and feasibility of outcomes assessment, gaining significant and meaningful faculty involvement may require incentives not yet offered. These may be most successful if they are designed to reinforce the link between outcomes assessment and instructional improvement. Faculty involvement at these levels will serve several purposes. Placing this control with faculty may reduce the perception of outcomes assessment as a threat and lead to more acceptance or participation in the process.

The level of expressed concern, coupled with the lack of strong attitudes toward the value and feasibility of outcomes assessment will result in a retarded implementation of assessment practices. Cooperative staff ventures in establishing outcomes assessment structures will be countered by the concerns and the mistrust toward administration.

Given this situation, it will be more difficult to get faculty involved, and the establishment and implementation of outcomes assessment will likely be done predominantly by administration. Once data are produced, their value will be questioned, and the tendency to accept them as a solid base for improvement will be diminished.

Summary of Conclusions

In summary, there were six major conclusions which resulted from this study:

1. Even though outcomes assessment was ordered by the Maryland Legislature in 1988, and guidelines subsequently published by the Maryland Higher Education Commission, a number of respondents indicated they were not aware of outcomes assessment or the role they would play in the process.

2. Although there was not strong opposition to outcomes assessment, it was not highly valued nor viewed as feasible.

3. Staff in four-year institutions valued outcomes assessment less than those in two-year institutions.

4. There was strong agreement that outcomes assessment should be used to improve instruction, but only moderate agreement that this will be achieved.

5. There was general agreement on the major indicators to be used, the role of faculty in design of the plan, and faculty priority for receiving the results.

6. Major concerns focused on the specifics of implementation and use of the results.

Recommendations

1. In developing plans for meeting state mandates for outcomes assessment, institutions should initiate deliberate processes to educate faculty and administration concerning state directives and the processes by which they evolved. A clear statement of purpose of the data gathering should be developed.

2. Faculty should be involved in developing the assessment plan in terms of purpose, types of data to be collected and use of the data. Faculty should participate in writing guidelines regarding uses of data as these might affect department budgets, salaries, promotions, and other personnel decisions. It is also recommended that guidelines be clearly articulated and published so that faculty will have a clear understanding of how the results of assessment will affect them. If this is done, it is more likely that the purpose of outcomes assessment to improve teaching and learning will be realized.

3. The survey results indicated fairly wide concern that assessment may be focused on measuring precisely what is easy to measure, but what may not be very meaningful or even antithetical to what respondents view as the primary purpose of the program – improving instruction. Therefore, it is recommended that faculty be provided with a large voice in defining what will be measured and that provisions be made for evaluating the effects of measurement on instructional behavior so that necessary revisions to measures can be made.

4. To obtain appropriate levels of faculty involvement in planning and implementing outcomes assessment programs so that it will serve such purposes as improving instruction in a meaningful way, it is recommended that MHEC and institutions together provide the environment (including retreats and workshops) and incentives (including release time of faculty) that will facilitate effective planning and acceptance of the plan.

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